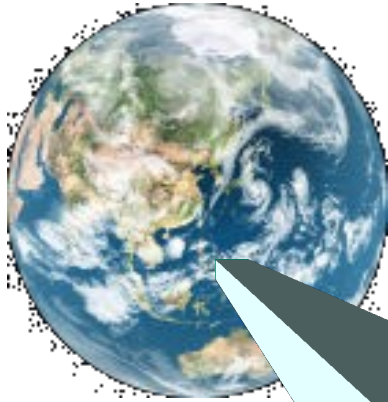


Environmental Support to M&S

Presented at the NAVMSMO 13th TIM on 31 March 2004

**Presented By
OPNAV N61F24**



<https://quickplace.hq.navy.mil/msea-ocean>

What is an MSEA?

DoD Directive 5000.59

DoD Modeling and Simulation (M&S) Management

- USD(AT&L) responsible for oversight and management of all DoD M&S.
- Authority to designate DoD Components as DoD M&S Executive Agents for the development of common-use M&S applications.

DoD M&S Executive Agent (MSEA)

A DoD Component to whom USD(AT&L) has assigned responsibility and delegated authority for the development and maintenance of a specific area of M&S application, including relevant standards and data bases, used by or common to many models and simulations.

DoDD 5000.59

Who Has MSEA Responsibilities

Modeling & Simulation Executive Agents (MSEAs)

- Ocean – Department of the Navy
- Air & Space – Department of the Air Force
- Terrain – National Geospatial-Intelligence Agency (NGA)
- Foreign Intel – Defense Intelligence Agency (DIA)

How Navy Became The MSEA For Ocean

- 1991 USD(A&T) established DMSO and EXCIMS.
- 1994 DoD Directive 5000.59, "DoD Modeling and Simulation (M&S) Management," January 4, 1994, stated need for MSEAs.
- 1994 Procedures for designating MSEAs established.
- 1995 N096 recommended to DDR&E that N096 be MSEA for Atmosphere and Ocean.
- 1995 DDR&E accepted N096's application.
- 1995-96 USD(A&T) designated DMA (now NGA) as MSEA Terrain.
- 1996 Competition between Air Force (XOW), Navy (N096) and Army for Atmosphere MSEA.

USD(A&T) designated Navy as MSEA Ocean, Air Force as

USD (A&T) Designation Letter



ACQUISITION AND
TECHNOLOGY

THE UNDER SECRETARY OF DEFENSE
3010 DEFENSE PENTAGON
WASHINGTON, D.C. 20301-3010



APR 9 1996

MEMORANDUM FOR SECRETARY OF THE NAVY

SUBJECT: Designation of the Department of the Navy (Navy) as DoD Modeling and Simulation (M&S) Executive Agent (MSEA) for Ocean Natural Environment Representations

Under the authority of DoD Directive 5000.59, "DoD Modeling and Simulation (M&S) Management," the Department of the Navy is designated as the DoD MSEA for Ocean Natural Environment Representations. This designation shall continue in effect until canceled.

This designation grants the Department of the Navy the authority to coordinate all aspects of DoD modeling and simulation related to representations of the ocean natural environment. As a DoD MSEA, the Department of the Navy is accountable to the larger DoD-wide M&S community through the DoD Executive Council for Modeling and Simulation. The Department of the Navy shall be respon-

MEMORANDUM FOR SECRETARY OF THE NAVY

Subject: Designation of the Department of the Navy (Navy) as DoD Modeling and Simulation (M&S) Executive Agent (MSEA) for Ocean Natural Environment Representations

An attachment is provided to further define areas of performance and exclusion.

Paul Kaminski

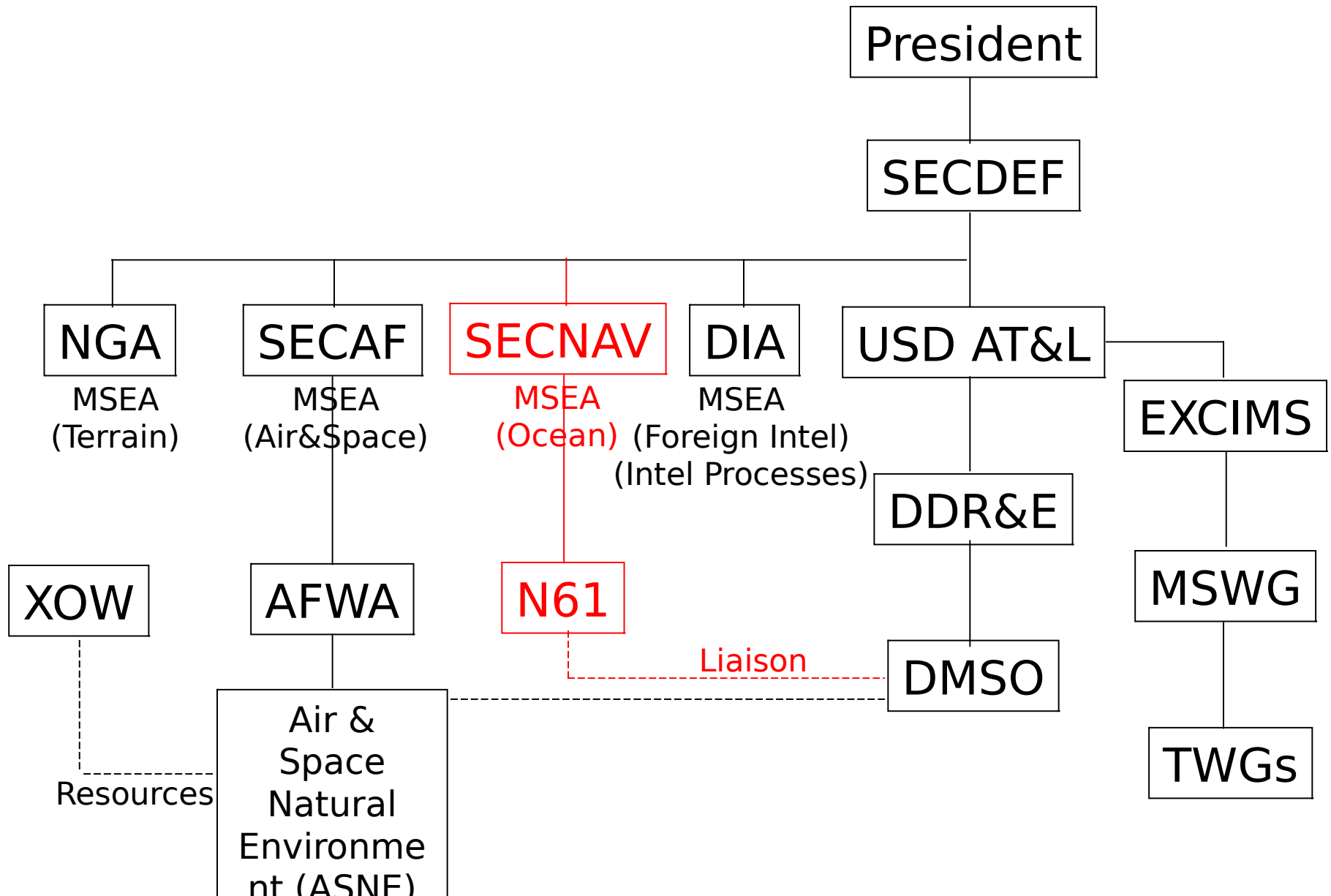
Paul G. Kaminski

Attachment
As stated

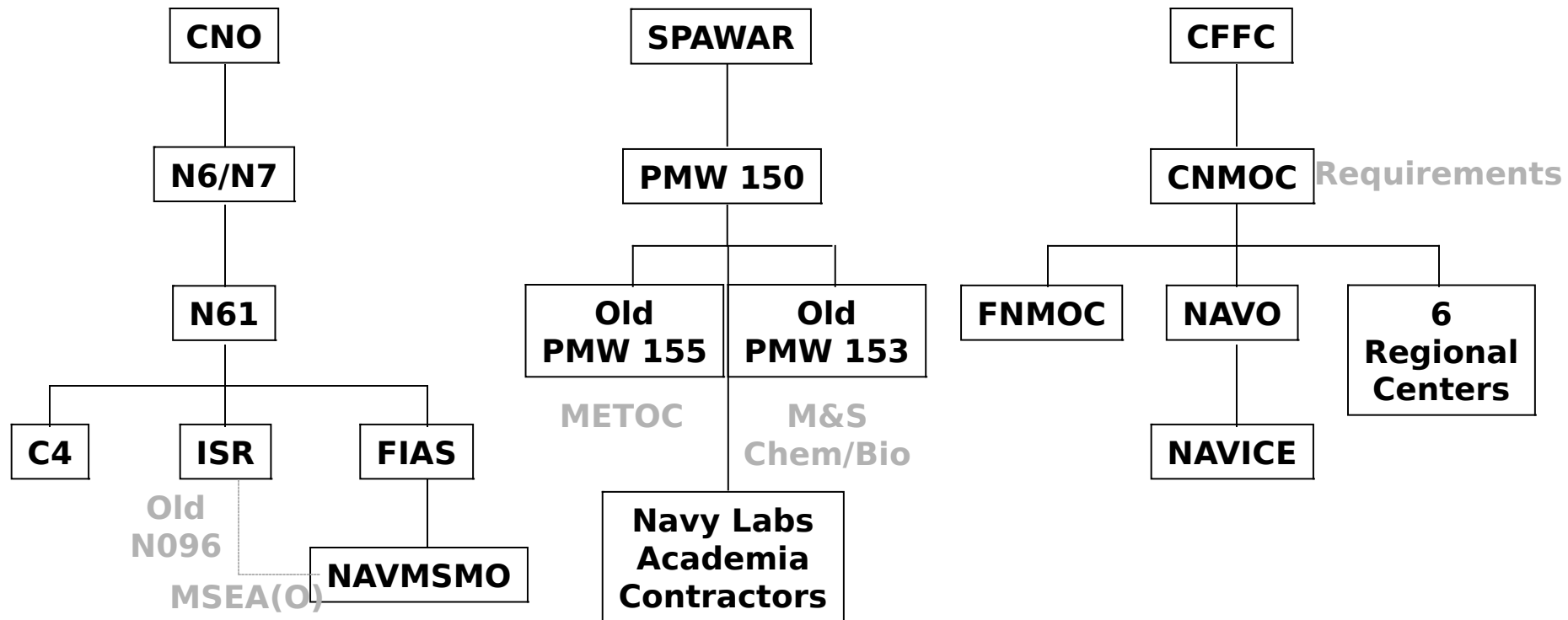
cc:
See Distribution

Where Navy Fits

Circa 2003



New Navy METOC Support Organization



- Resource Sponsor
- Validate/Prioritize Requirements
- Policy
- POM (Funding Priorities)

- Program Management
- Model Development
- System Development

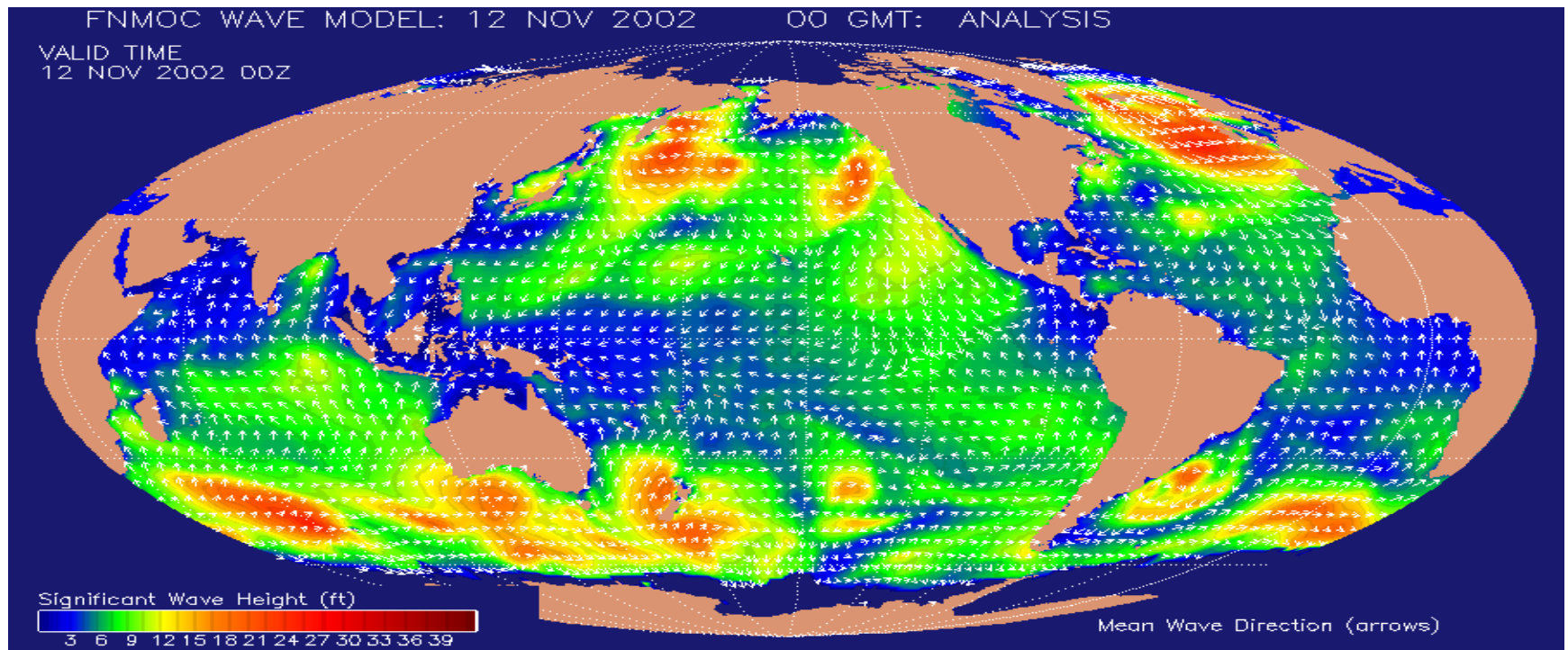
- Operational Command
- Surveys
- Database Development
- Configuration Management
- Daily METOC Forecasts
- Support to Fleet Ops

ISR = Intelligence, Surveillance, Reconnaissance
 FIAS = FORCEnet Innovation, Architecture, Standards

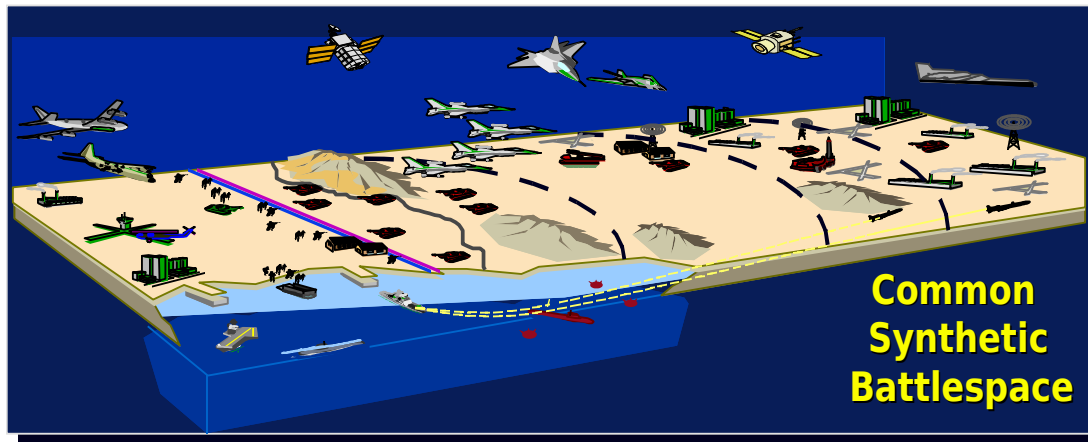
**No realistic maritime simulation
Navy-unique environment forces can be
conducted without an in-depth
understanding of the ocean
and its effect on platforms,
weapon systems and sensors.**



**The Oceanographer of the Navy
leverages
Research & Development
and
Operational Capabilities
to provide the required ocean
environment to DoD simulations.**



The Oceanographer supports Fleet & Joint operations in many ways ... and with many products.



**Sea State
Waves
Sea Surface Temperature
Sound Speed Profiles
Temperature Profile
Salinity Profile
Turbidity
Currents
Surf
Tides
Harbor Conditions
Bottom Type
Bathymetry
Biologics**

**Weapons Performance
Sensor Performance
Platform Response
Platform Safety**

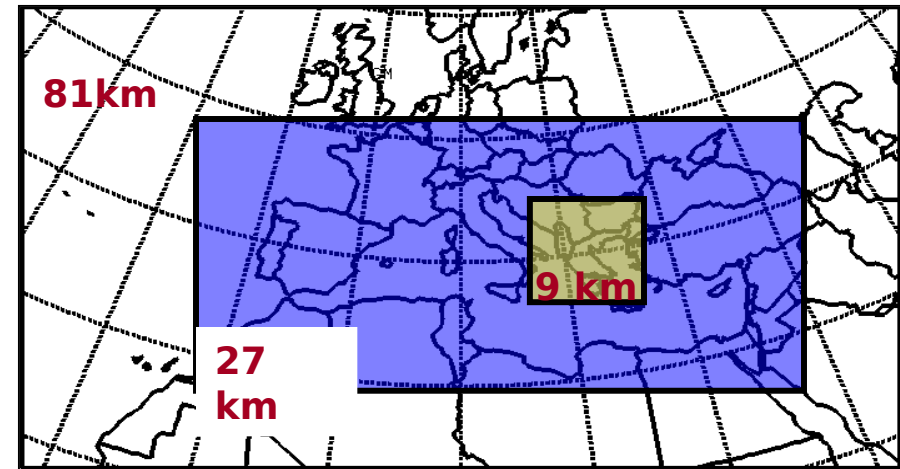
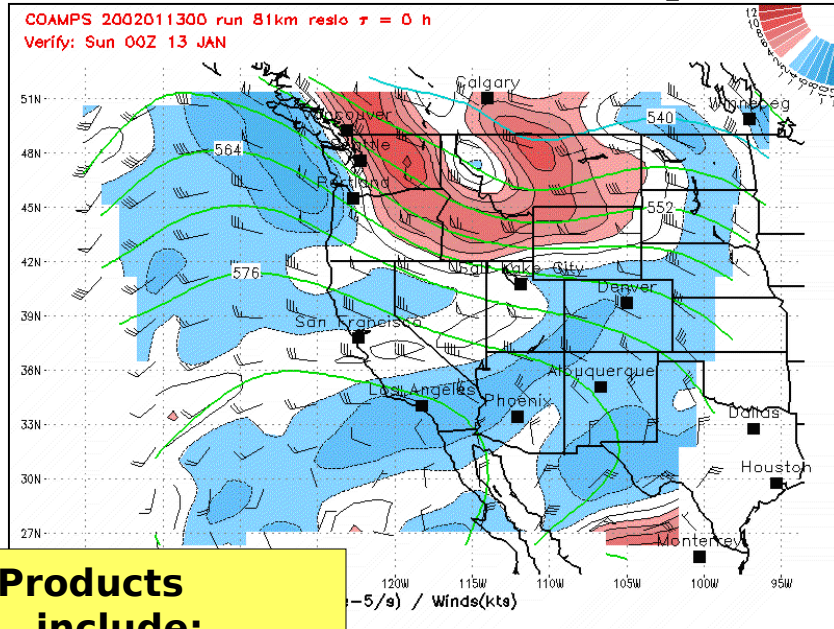
**Mine Warfare
Strike Warfare
Special Operations
Antisurface Warfare
Amphibious Warfare
Antisubmarine Warfare
Joint Logistics Over the Shore
Military Operations Other
Than War**

Oceanographic & Atmospheric Master Library (OAML)

A library of oceanic, atmospheric and acoustic models, databases and algorithms.

- **58** Navy Standard Core Models, Databases, and Algorithms
 - (19) Data Bases; (32) Models; (7) Algorithms
 - **25** Presently Approved For Development
 - (13) Data Bases; (8) Models; (4) Algorithms
- OAML is
 - Free to DOD and their contractors
 - A Navy standard used by the Warfighter
 - Verified and Validated products
 - Maintained through O&MN funds

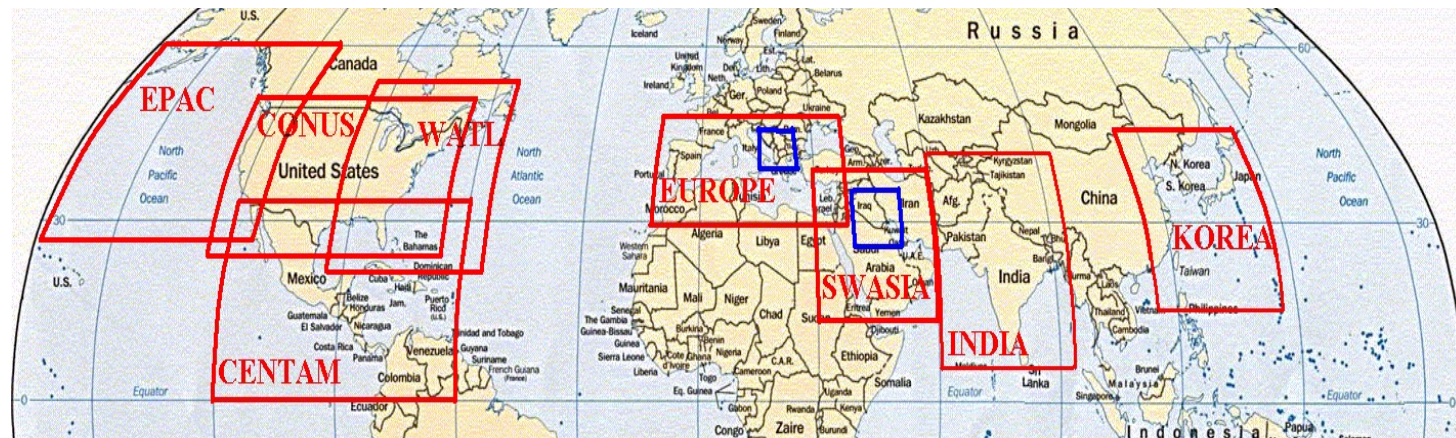
Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS)



Flexible multi-grid nesting

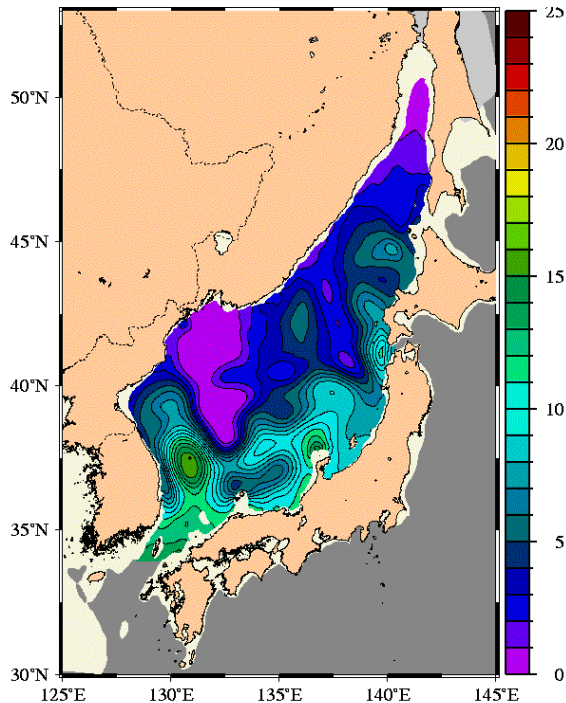
Products include:

- wind components
- potential temperature
- mixing ratio
- surface pressure
- ground temperature
- ground wetness
- sea surface

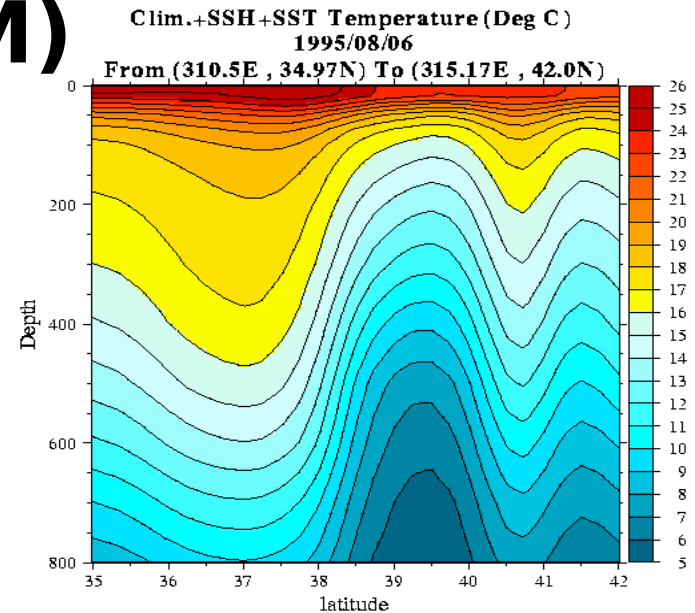


FNMOC Operational Regions

Modular Ocean Data Assimilation System (MODAS) and Navy Coastal Ocean Model (NCOM)



Ocean volume information (sound speed, temperature, salinity profiles) is computed to within 5 m water depth of the



Products include:

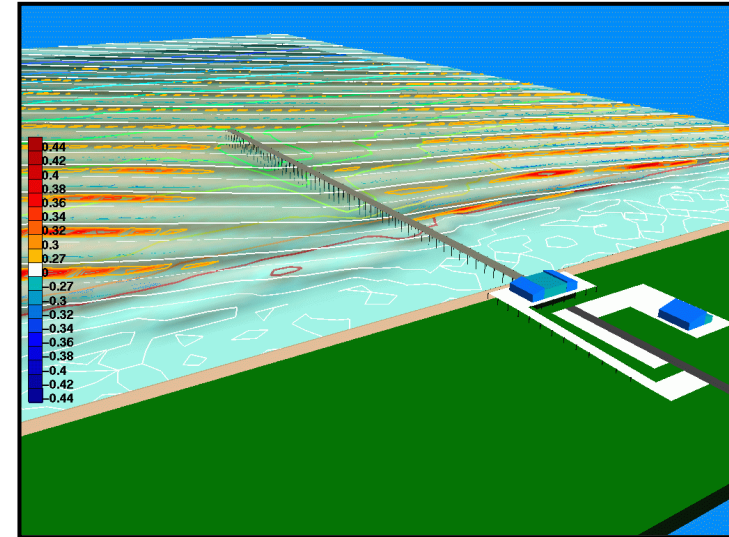
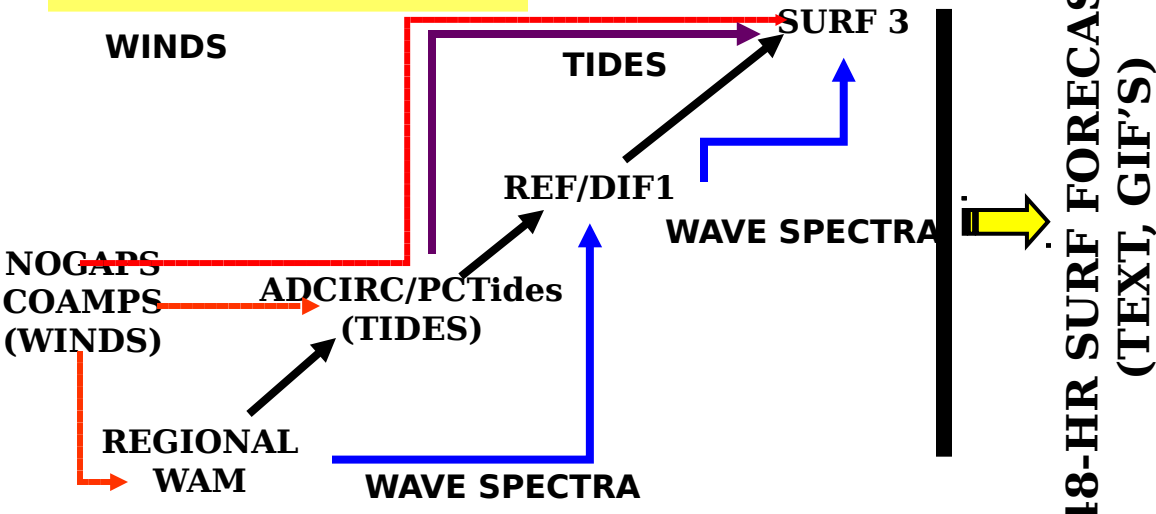
- **3D volumes of**
 - Temperature
 - Salinity
 - Sound speed
 - Currents
- **2D derived quantities of the above at**
 - Arbitrary depths
 - Mixed layer depth
 - Sonic layer depth
 - Deep/shallow sound channel axes

Distributed Integrated Ocean Prediction System (DIOPS)

Provides a physically consistent representation of the surf zone.

Products include:

- Wave Height and direction
- Wave-current interaction
- Significant wave height
- Significant breaker height
- Peak period
- Tides
- Breaker period
- Breaker Type:
 - Spilling, Plunging, Surging
- Breaker angle
- Surf zone width
- Longshore current
- Modified Surf Index

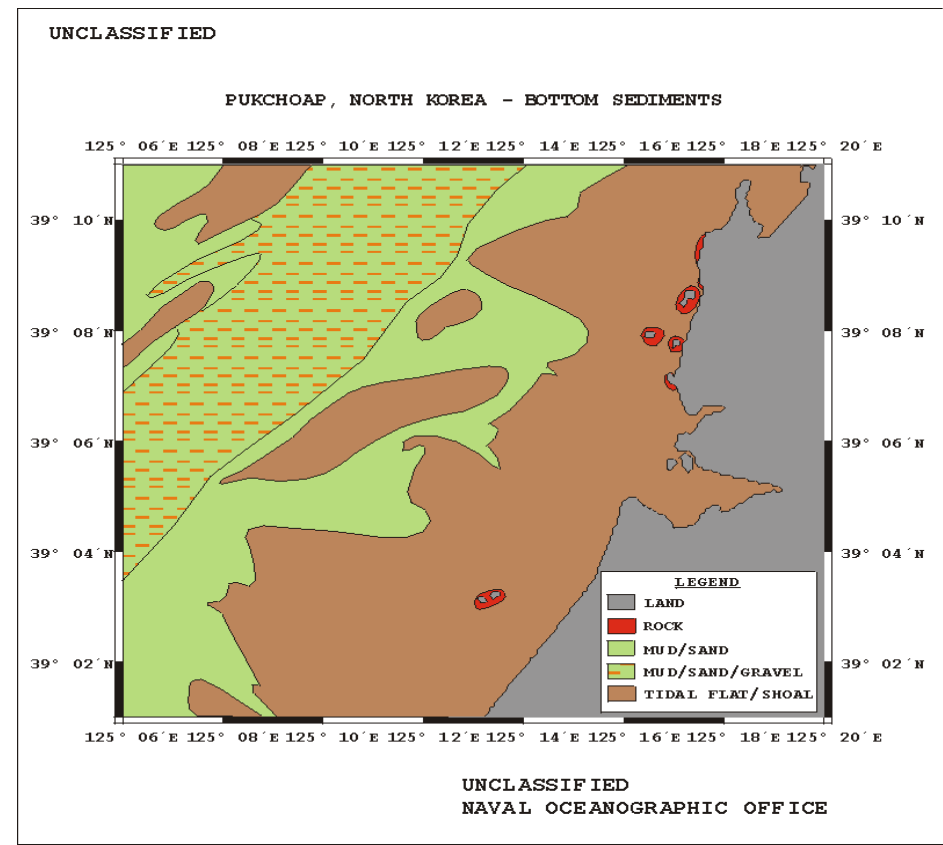


Mud Flats and Expeditionary Warfare



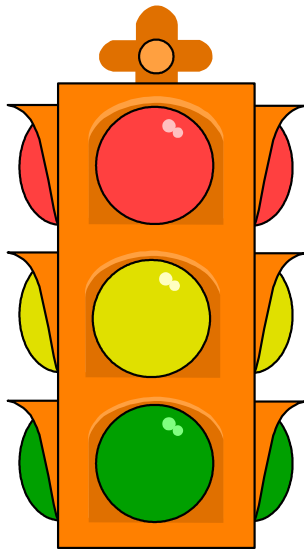
Products include:

- Photos
- Satellite Images
- Digital Databases



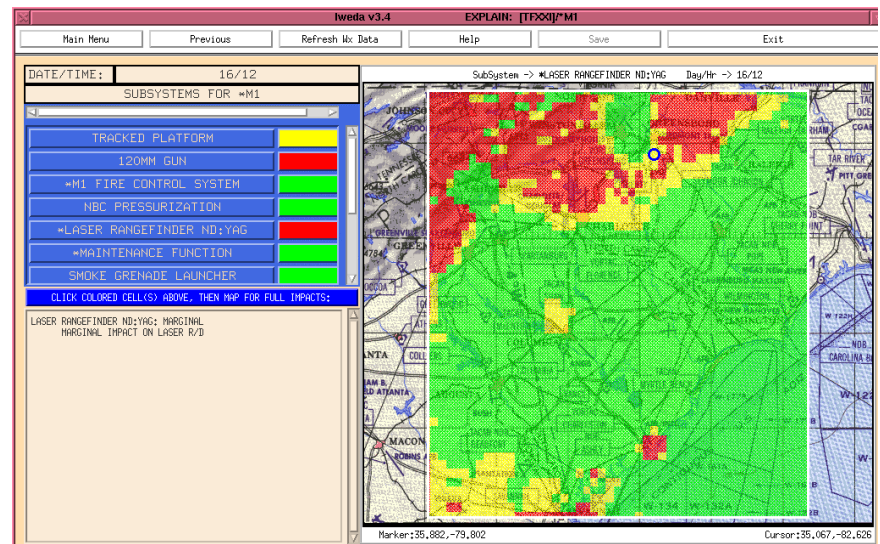
Integrated Weather Effects Decision Aid Rules (IWEDA)

An initiative to present the impacts of the environment on platforms, weapons and sensors (using the Army's IWEDA rule set format as a basis).



iweda v3.78System Weather Effects Matrix

Main Menu	Previous	Refresh Weather Data	Help	Exit				
A-10	R	R	R	R	R	R	R	
CHAPARRAL	A	A	G	G	G	A	A	
M109 SP HOWITZER	R	R	R	R	R	R	R	
PERSONNEL	R	R	R	R	R	R	R	
M1	R	A	A	A	A	R	R	
AH-64	R	R	R	R	R	R	R	
ISA-141	R	A	A	A	A	R	R	
DATE/HOUR (Zulu Time):	31/14				01/02			01/14
LEGEND:	Unfavorable		Marginal		Favorable			

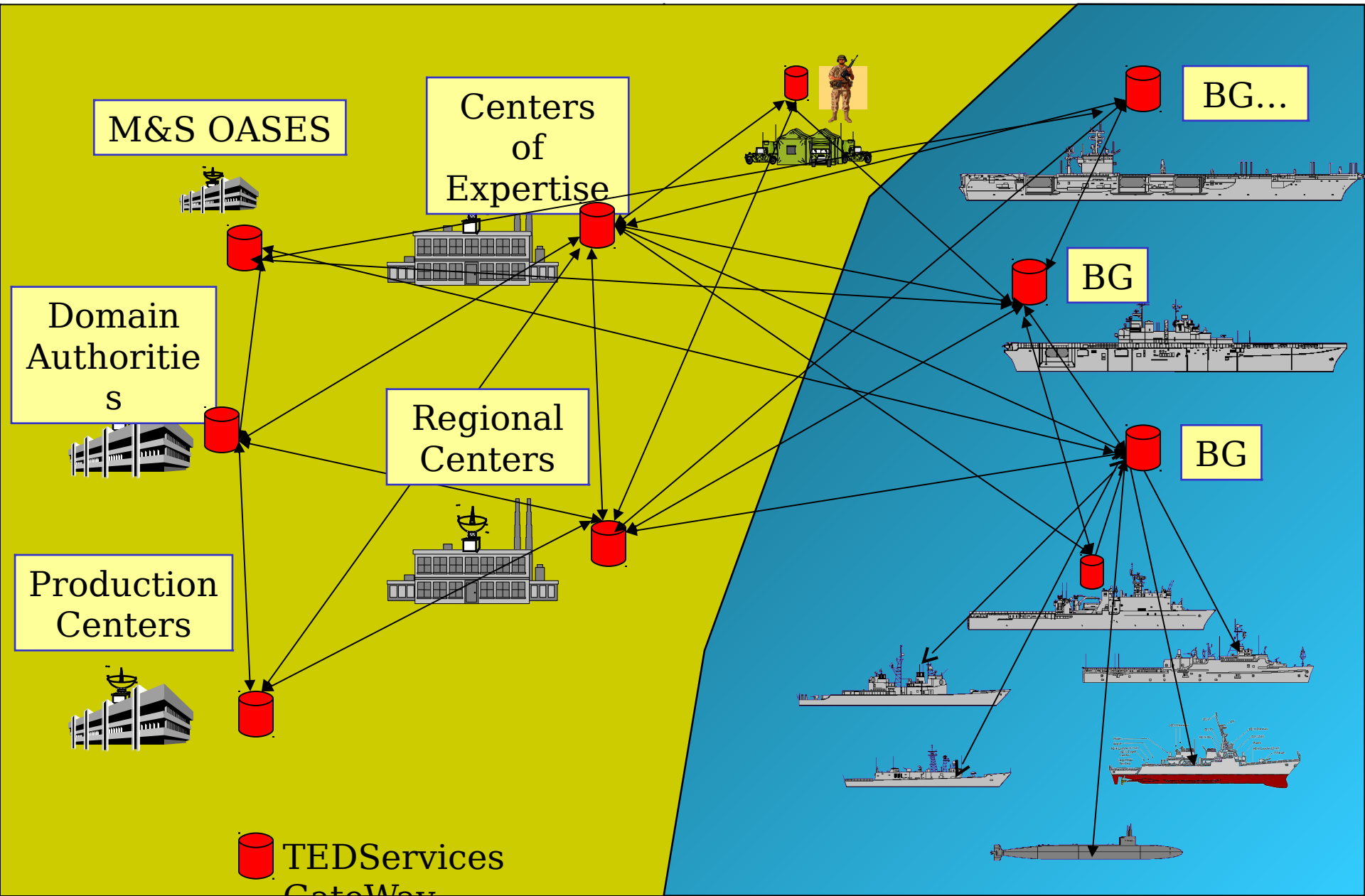


Tactical Environmental Data Services (TEDServices)

TEDServices is a revolutionary solution to the problem of transporting data, from Producers to Consumers, within a network-centric warfighter environment.

TEDServices provides an embedded “many-to-many” distributed data management solution that seamlessly delivers and represents data to Tactical Decision Aids and Applications.

TEDServices, “Many-to-Many”



Major Milestones To Date

- **Expanded METOC play in**
 - **POM 06 & PR 07 Processes**
 - **JWARS**
 - **Global War Games**
- **Helped develop NAVO MEL Resource Site, INEARP Strategy and CONOPS**
- **Promoted METOC use in M&S through Education and Outreach**
 - **Inserted METOC in DoD M&S Staff Officer Course**
 - **Seminars, conferences, meetings**
 - **JTS/IWEDA rules in JWARS, INEARP and Global War Games**
- **Promoted METOC play in Fleet Battle Experiments**
 - **OASES/TEDServices**
- **Leveraged DoD resources to expand Navy capabilities**
 - **Instrumental in development of Distributed Integrated Ocean Prediction System (DIOPS)**
 - **Instrumental in development of Developed Model Response Investigation Characterization and Visualization (MIV) methodology**

Statement of Problems & Issues

- **Limited use of the environment in M&S**
 - **Legacy models don't use a robust environment**
 - **Hard to get the environment needed**
- **Inadequate consideration of the environment in the development of CONOPS**
- **Little to no consideration of environment on new systems**
- **Increased emphasis in the littoral implies data resolution issues**
 - **Collecting data in denied areas**
 - **Rapidly varying spatial and temporal domain**
- **Fiscal constraints**
 - **Maintaining a data production capability for the long term**
 - **Upgrading models to accept environmental information**

USD (A&T) Designation Letter Attachment

DoD Modeling and Simulation (M&S) Executive Agent (MSEA) Responsibilities

The Department of the Navy shall, as DoD MSEA for the ocean natural environment, establish a DoD center of excellence for M&S information, coordination, and expertise on ocean natural environment representations and their interactions with other environmental representations, establish an organizational focal point to interact with other DoD-level M&S organizations on DoD MSEA-related issues, and lead community consensus efforts.

In performing these functions, the Department of the Navy shall address all the issues and actions listed in the DoD M&S Master Plan to include::

- Be responsive to guidance from the Under Secretary of Defense for Acquisition and Technology (USD(A&T)) and the needs of the DoD M&S users and developers.
- Implement management processes with defined metrics to identify, evaluate, and resolve M&S management and technical issues.
- Collect and analyze user requirements.
- Develop a budget and establish a funding line in the DoD Budget for recurring DoD MSEA-related costs, including, as appropriate, operations and maintenance and research and development activities.
- Provide access to relevant M&S data and information through the DoD M&S Resource Repository.

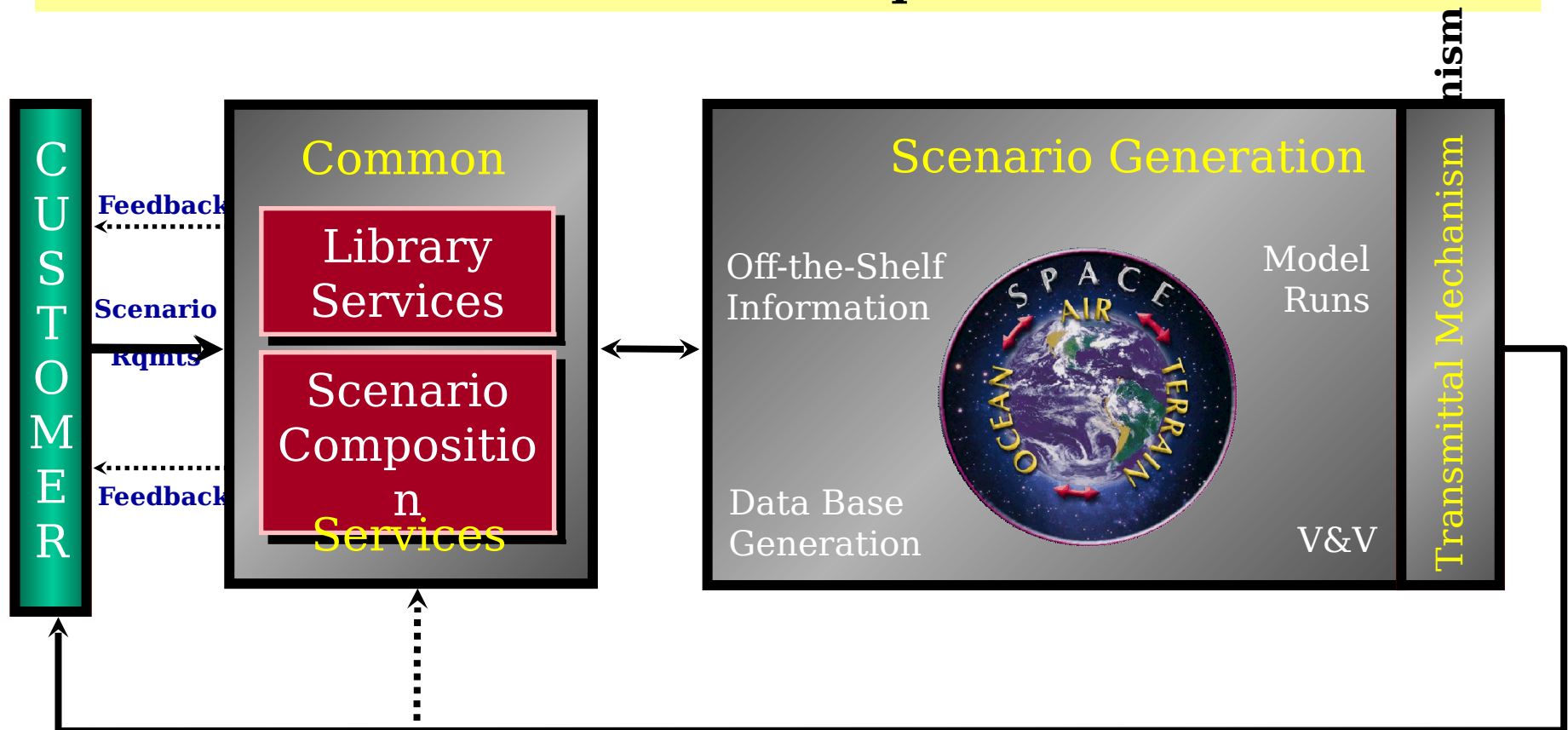
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production base at the expense of potentially qualified others.

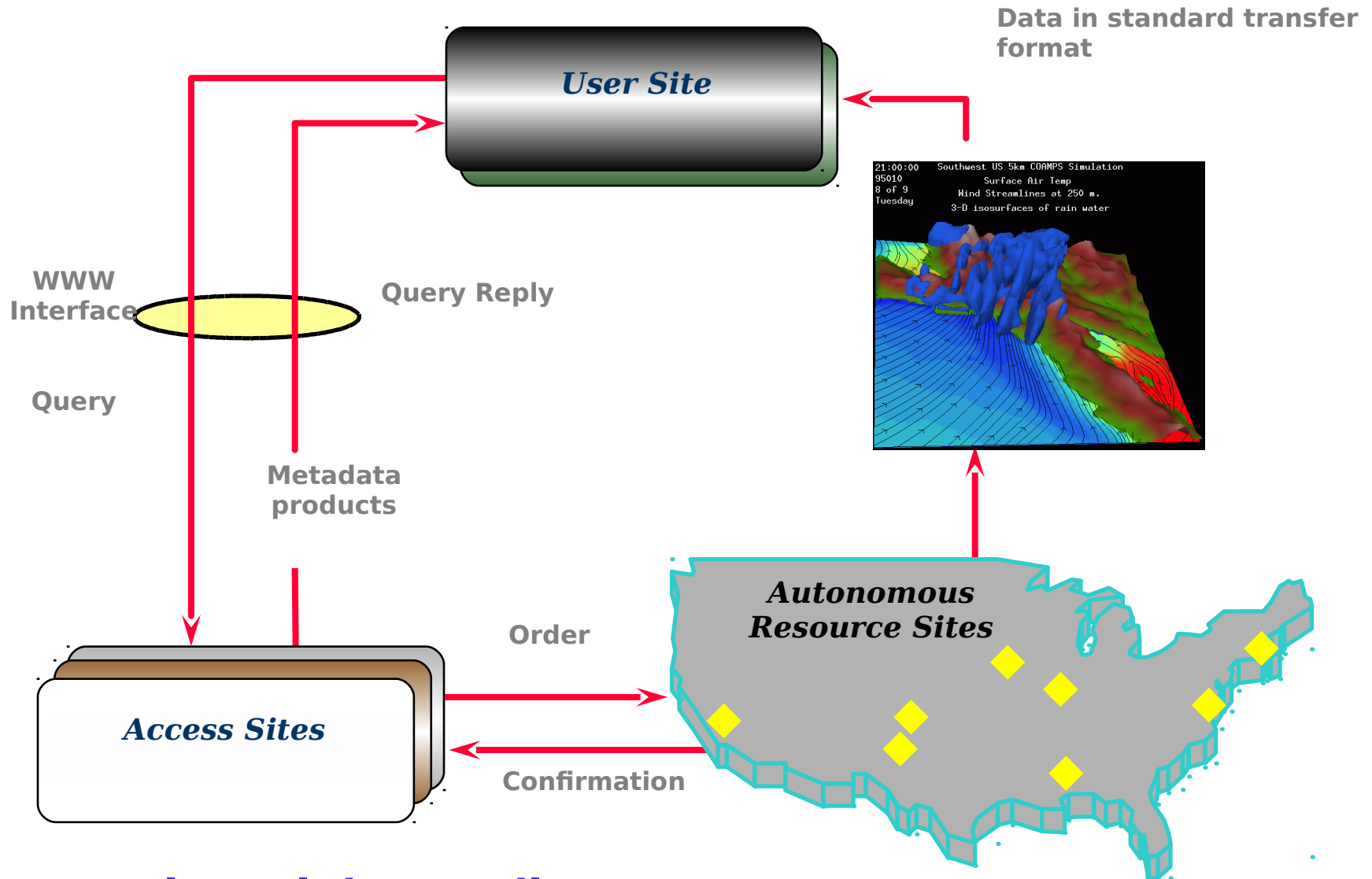
- Produce and mandate the use of specific software applications.
- Dictate standards that have not been subjected to appropriate standardization process review.

Integrated Natural Environment Authoritative Representation Process (INEARP)

Create a physically consistent, cross-domain,
authoritative “ground truth” of the natural environment
that meets user requirements



Master Environmental Library (MEL)



ESG Functionality



Intelligent Searching for
Meaningful Environmental
Events

Mapping of Customer
Requirements to the best
available off-the-shelf or
custom-produced resources for
M&S

Inter-Domain Production
Coordination

Operational System at AFCCC

<https://esgweb.afccc.af.mil/Esq>

Online Data Analysis of all
Resources

For Access Contact:

ASNE/MSEA or

esghelp@saic-ine.com

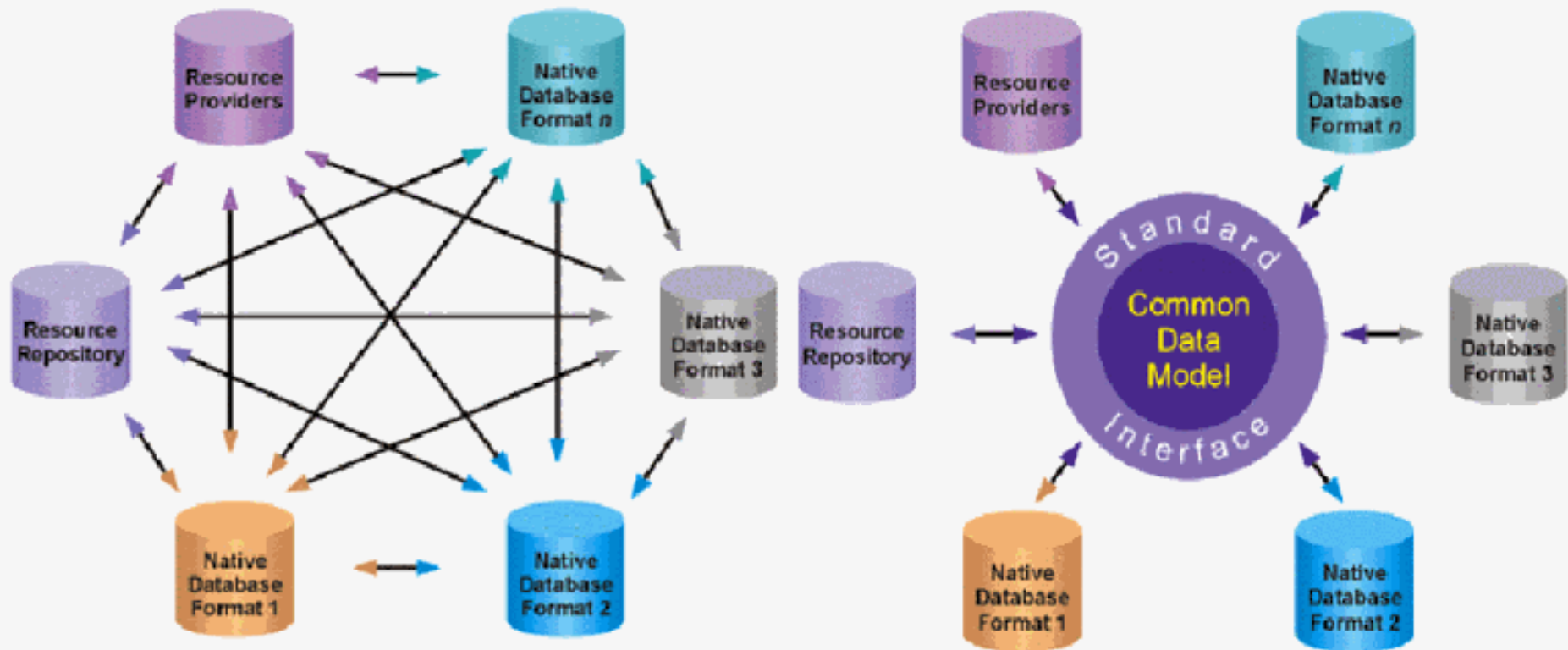
Demonstrated

Application supporting
Custom Formats, Terminology
and Units
**atmosphere, ocean, and
space domains**

Primary Aspects of SEDRIS

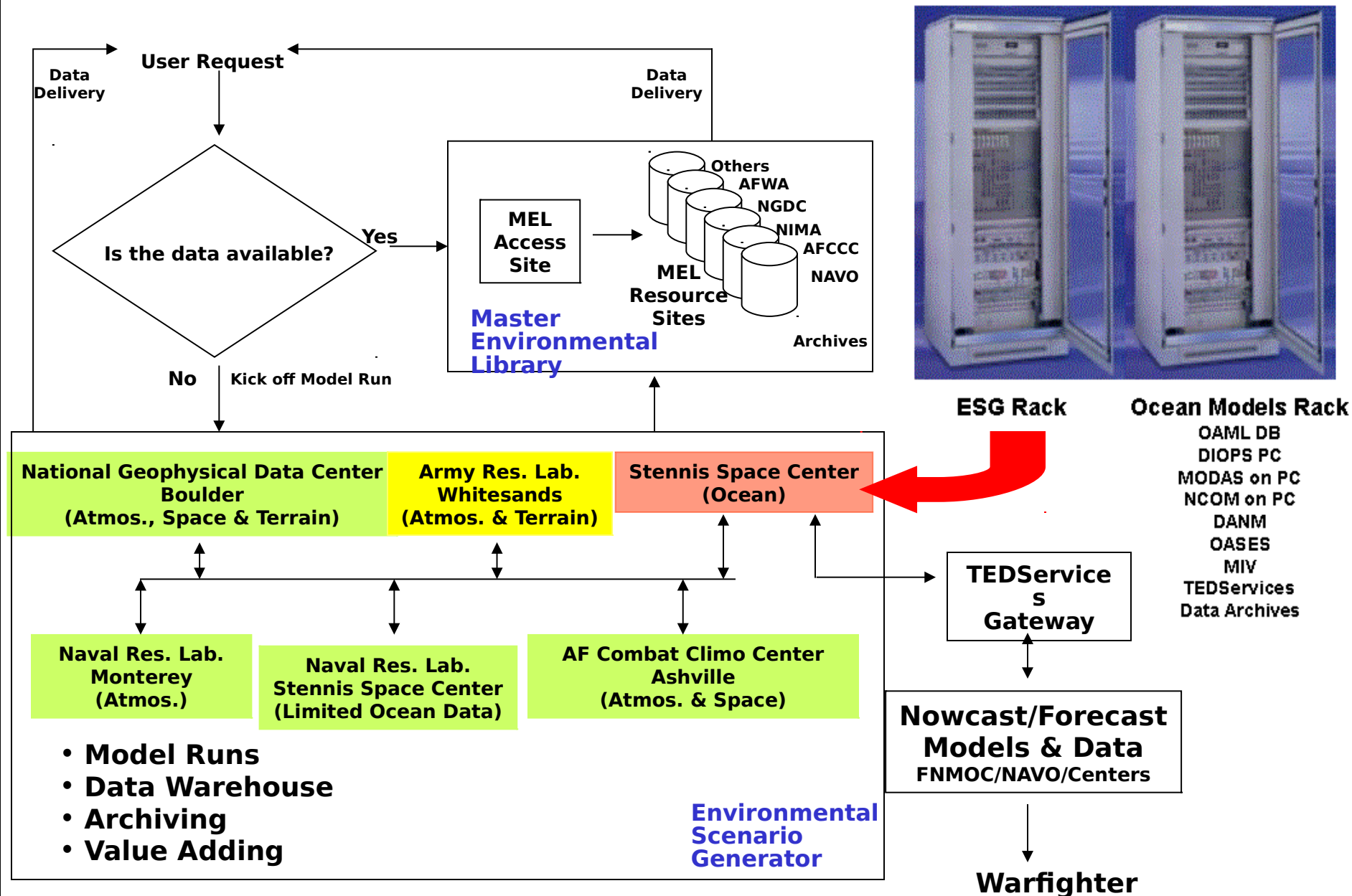
Synthetic Environmental Data Representation & Interchange Specification

- **Unambiguous representation of environmental data**
 - Data Representation Model
 - Environmental Data Coding Specification
 - Spatial Reference Model
- **Efficient interchange of environmental data**
 - Interface Specification
 - Transmittal Format
 - Tools & Applications



Enhance Current NAVO INEARP Capabilities

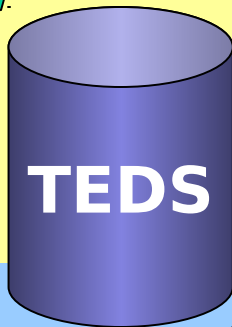
(A Navy Ocean Center of Excellence)



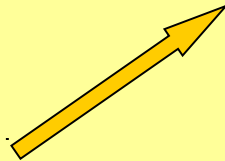
Linking Operations and Simulation

LIVE

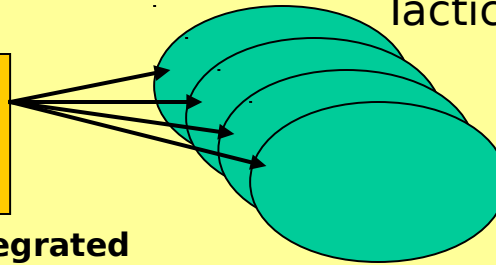
Operational
METOC Data



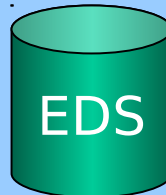
Tactical
Environmental
Data
Services



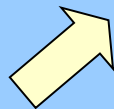
Naval Integrated
Tactical
Environmental
System



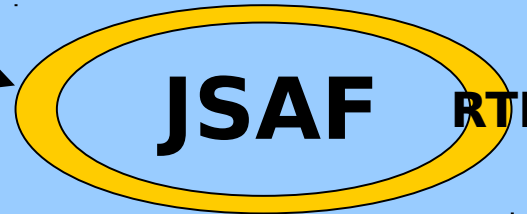
Individual
Tactical Decision Aids



Environmental
Data Server
(OASES)



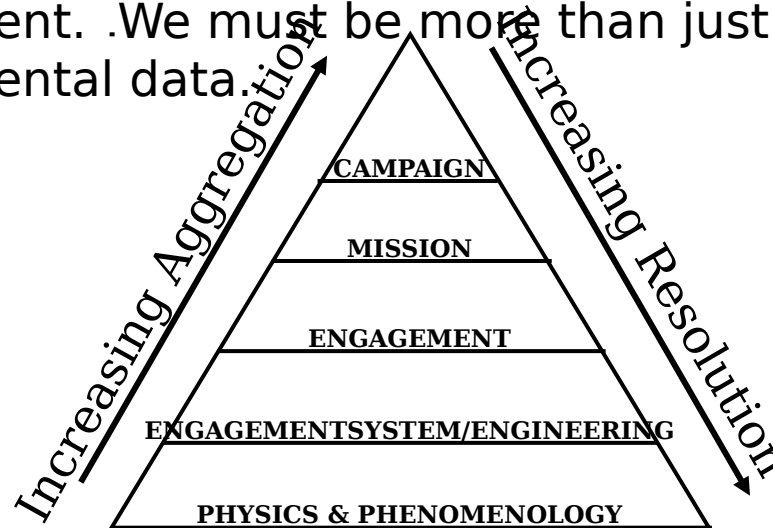
Ocean Model Data



SIMULATION

Summary

- **The ocean environment is critical to system/platform design, performance and force structure planning.**
 - The Oceanographer should be involved with M&S customers from the beginning of simulation development to help determine how best to make use of the environment. We must be more than just a provider of environmental data.



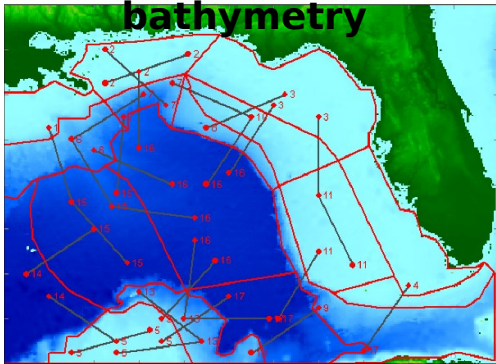
- **Sea Power 21 puts big demands on littoral capabilities.**
- **We need one environmental support architecture**

Backup Slides

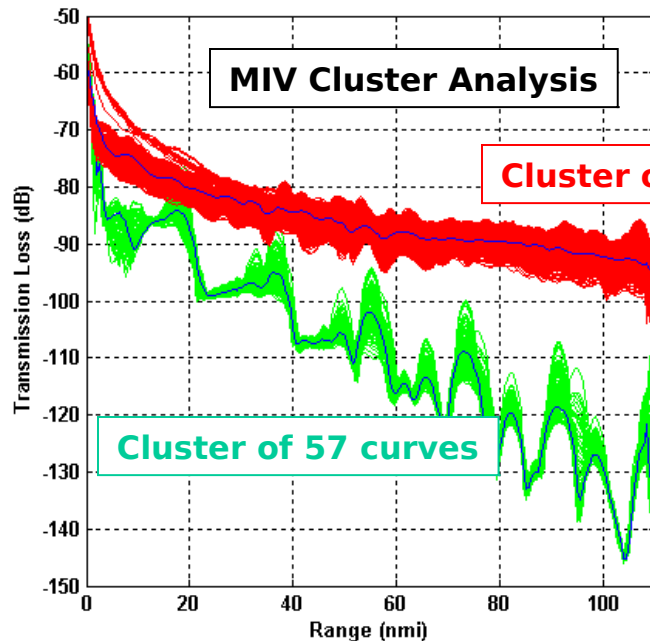
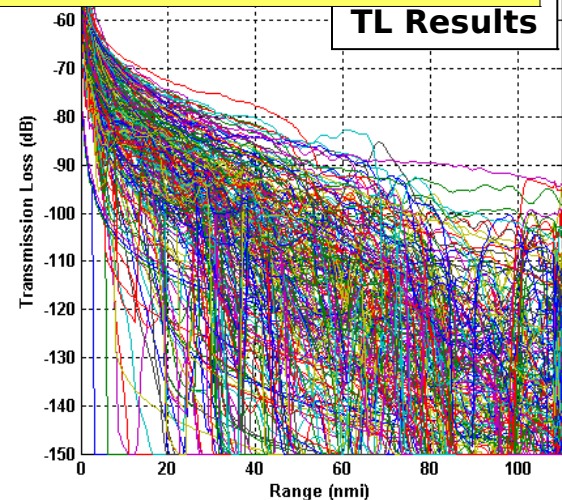
MODEL-RESPONSE INVESTIGATION AND VISUALIZATION (MIV)

A methodology for using cluster analysis to characterize the way in which an environmental effects model (e.g. acoustic propagation) responds to a particular environment.

Feature-areas
overlaid on
bathymetry



Generate acoustic
transmission loss
(TL) for multiple
representative
propagation paths
within exercise area



Compact TL Library
(say, **250** TL curves)
representing entire
range of TL
behaviors

TL
Directory

The INEARP

The Integrated Natural Environment Authoritative Representation Process (INEARP)

- **DMSO-funded initiative**
- **DoD M&S Executive Agent participation**

Purpose

To create a synthetic natural environment that is physically consistent from the atmosphere to the terrain to the ocean bottom for use in war games and simulations.

It currently consists of

- **Master Environmental Library (MEL)**
- **Environmental Scenario Generator (ESG)**
- **Synthetic Environment Data Representation and Interchange Specification (SEDRIS)**

Air Force MSEA office is the primary provider of data today using this process.

Acoustic Models

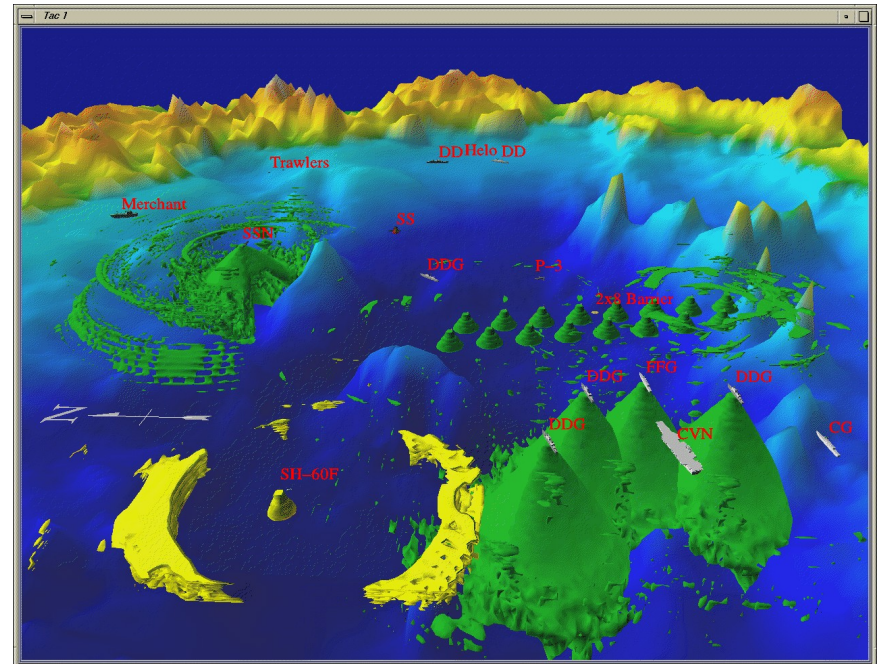
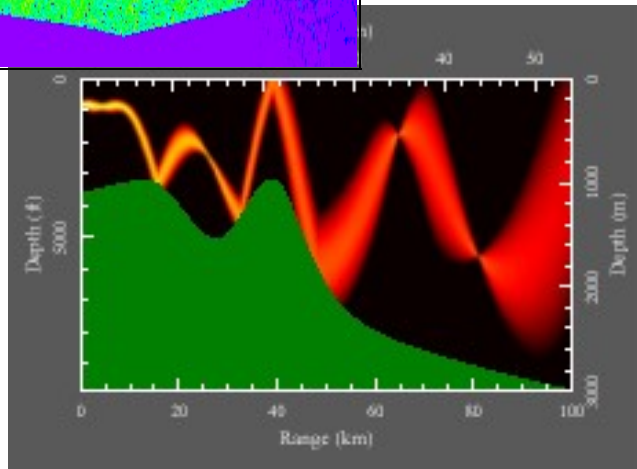
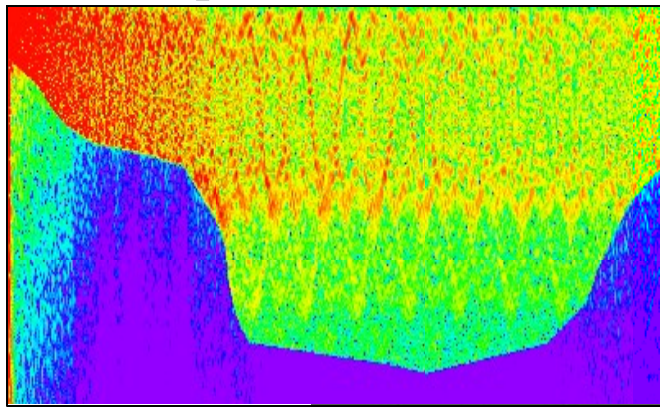
Transmission loss

Ocean surface and bottom loss

Beam pattern loss due to rough sediment scattering

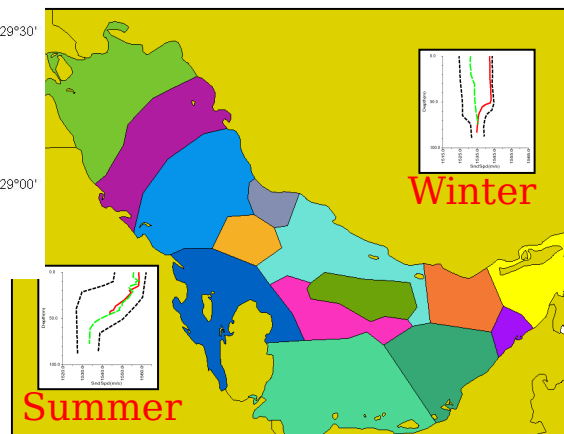
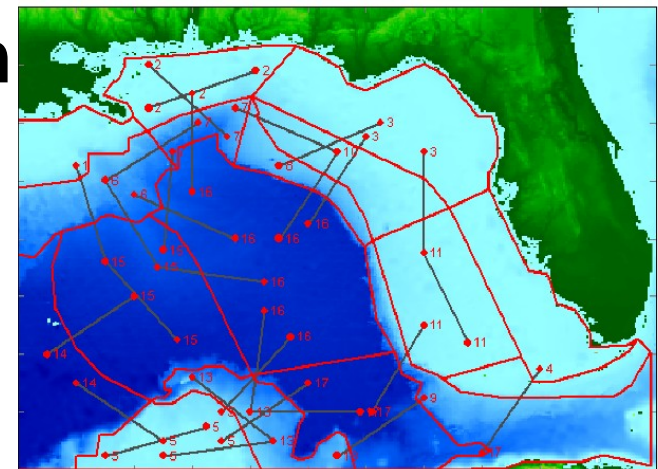
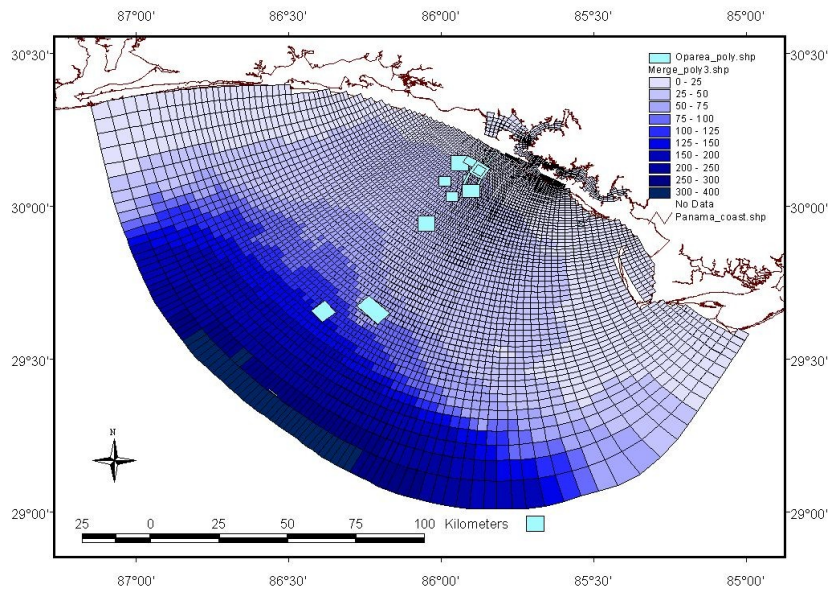
Active sensor acoustic loss due to ocean bottom

Computer-aided sonar tactical recommendations



Acoustic Databases

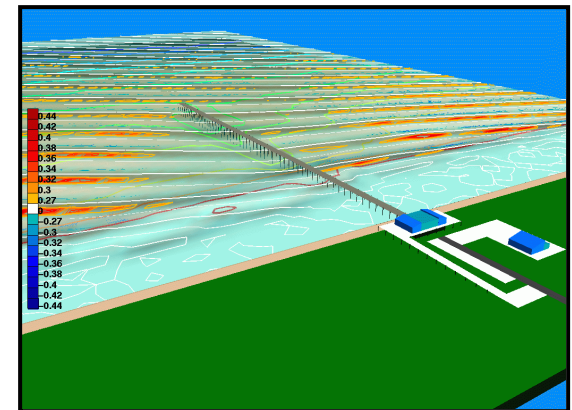
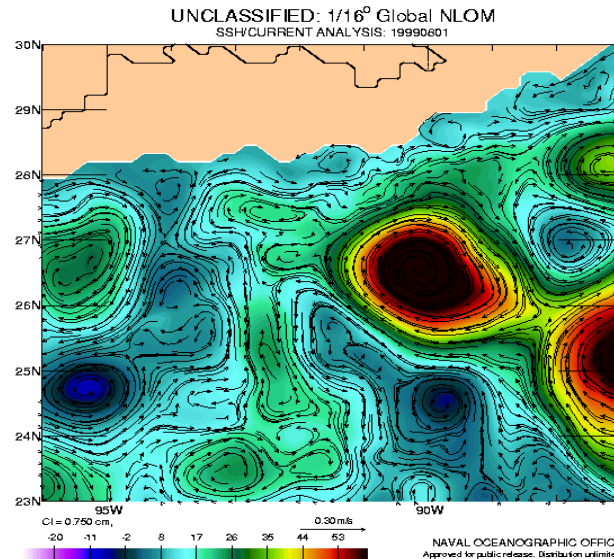
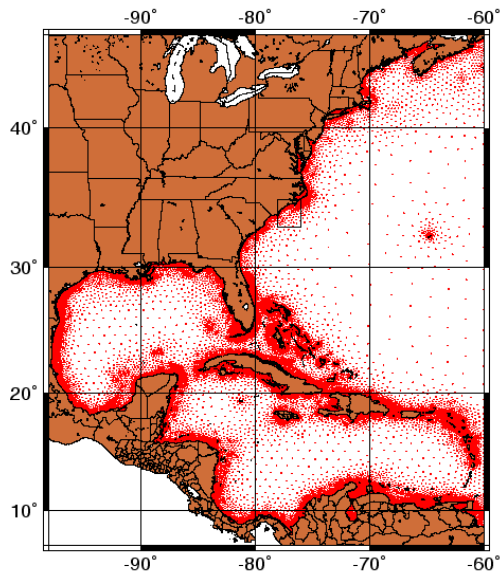
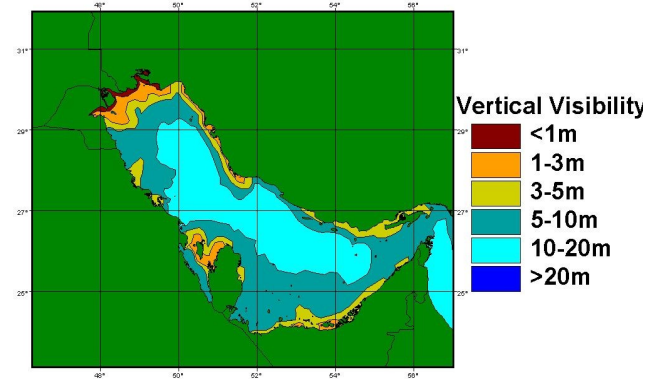
High and low frequency bottom loss
Volume scattering strength
Wind and shipping noise
Vertical line array noise ga



Ocean Models

Waves
Tides
Currents
Surf
Optics

Persian Gulf Vertical Visibility
Fall



Ocean Databases

Temperature/salinity/sound s
Digital bathymetric database
Shipping density
Polar ice cover

